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DEC. 27, 1954

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Domestic

Crash investigators from Civil Aeronautics Board are working, collaborated with five experts from Italy in preliminary findings on an Italian military DC-68 that plunged into Jamaica Bay on the edge of New York's International Airport Dec. 18, killing 28 of the 33 persons aboard. The Rome-New York transport was making its fourth attempt to land in light rain and fog when it struck the tip of a landing light pole, crashed and burned. Five helicopters, two Bell 47s and two Sikorski H-35s, played a major role in the rescue work.

Emphasis of airplanes as the backbone of U.S. armed forces was pointed up again last week by Defense Secretary Charles F. Wilson, who announced more than 400,000 men will be cut from the military while USAF will grow larger. The Air Force will grow from its present 94,000 to 975,000 by next June and 975,000 by June 30, 1956.

Double speed record for Macon-New York flights was set Dec. 19 by a National Airlines DC-7E flying to leave 2 hr. 27.5 min. Back to back: 2 hr. 31 min. The transport maintained an average speed of 440 mph and hit a maximum of 585 mph, noted by "light" indicators.

First Navy T-34B has been delivered on schedule by Boeing Aircraft Corp. at Wichita. The 175 mph trainer, powered by a 2354-hp Continental engine, also is used at present by USAF, Canada, Chile, Colombia, El Salvador and Japan.

Lackland Aircraft Corp. has received a new Navy order for 45 F2V-3 Neptune, extending production of the battle-killer plane into late 1956.

Fairchild Engine & Airplane Corp. has sold its 1,000th C-119 cargo transport after popularizing it at Hagerstown, Md., and delivered the two-engine, twin-boom Flying Boxcar to the Air Force.

Wright Aeronautical Division of Curtiss-Wright Corp. has received National Safety Council's award of honor for a record 4,420,544 hours without a disabling injury.

Last T-33B trainer produced by North American Aviation's Downey, Calif., plant has been delivered to the Navy.



B-45 Testbed Aids J40 Jet Development

Increasing the altitude at which the Westinghouse J40 turbojet's afterburner can be ignited is the aim of a development program involving the North American B-45A. Turbine firing troubles shared with the jet-engine under its hooding. The J40 flight program, as being carried out at Hensley Field, Dallas, with Vought Aircraft Corp. handling data collection and analysis plus accessory supply and other services.

International

Trans-Canada Air Lines' Super Constellation crashed and burned Dec. 17 near Tulsa from its destination on a flight from Tampa, Fla., to Toronto. None of the 23 persons aboard was killed.

Streamlined indigenous transports are being designed by Harid Dabson and Kacou, will be studied by a special group representing all French airlines. Both transports probably will be powered by two Rolls-Royce Turbines.

Britain's lagging production of turbo-propelled bombers and fighters has forced the government to consider acquiring its vintage Ministry of Production aircraft, according to joint reports. Prime Minister Sir Winston Churchill says delays in deliveries to the Royal Air Force and Royal Navy are being corrected.

J. P. F. Verheem, 55, member of Canada's three-man Air Transport Board, former pilot who helped equip southern air routes and master of the Macker trophy, died Dec. 17 at Ottawa.

Sabena Belgian Airlines is taking the corporate name of Sabena Belgian World Airlines.

Swedish turbojet producer, Svenska Flygmotor AB at Trollhachan, is beginning a \$3-million expansion program based primarily on a new contract signed with the Royal Swedish Air Force. RCAF is reported to be trying to supply its future needs totally within Sweden.

Financial

International Air Transport Association scheduled airline traffic transactions put through its clearinghouse during the last nine months of 1954 totaled \$193,567,000, an increase of 15.1% over the \$170,045,000 for the same period last year.



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December 27, 1954

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Washington Roundup

Philadelphia for Airshow?

Philadelphia is a dark horse entry in the 1955 National Aircraft Show competition.

Loren K. Friedman, city's director of tourism, told *Aviation Week* Philadelphia is drafting a formal invitation with an outline of its program and pledge of \$50,000 from the chamber of commerce to help finance the show.

Friedman and chamber officials have met with other area leaders and Ron T. Fausch, general manager of the show, to discuss the prospects.

Philadelphia has become a strong contender for the 1955 exhibit. Franklin said he would like to see it held in the center of the East Coast's most concentrated population area with good travel facilities nearby.

Philadelphia is a dark horse entry in the 1955 National Aircraft Show competition.

Friedman said Philadelphia's International Airport, where a new \$10-million terminal was opened a year ago, has more ramp space available for state exhibits than any previous site used in the show.

The field has four large hangars, two occupied by Trans World Airlines and the Air National Guard.

Friedman says it is a candidate that at least has and probably more of the facilities can be made available.

In addition, the airport's old terminal building can be used.

Only standing block to airshow plan remains in the Fortmeyer, where a top-level decision is expected at least by mid-February.

Indications are that the Secretary of Defense Department support for the show at Fortmeyer next month. Navy is known to oppose construction of the show.

An Air Force strongly favors the exhibition.

Support for Feeders

Congress by local service airlines for permanent certification has given support from CAB member for Alaska but the other four CAB members will oppose the measure.

Latest statements of position came in a series of letters from Adams and CAB Chairman Clay Green to Sen. John Breaux, chairman of the Senate Interstate and Foreign Commerce Committee, which will act on legislation aimed at permanent certification.

Sen. Green said "The Board continues to believe that legislation pending permanent certification to all of the existing local service carriers would be unwelcome at this time."

There is no showing of reversal of the unimpeachable word of wisdom.

Sen. Adams said "It is our belief that the air transport system offers the smaller communities the most direct service and is as permanent as the communities themselves."

Permanent certification suggested by Adams would have a decision in the House during 1955, with some possible points that could be adjusted as traffic patterns developed, thus making an element of flexibility in the certification.

Procurement Red Tape

Thursdays military procurement officials sometimes mentioned by criticism and criticism have a justified feeling that too few people realize how many things have to be considered in making a purchase.

It is with a feeling of finding the best product at the lowest price, despite the political friction that are bound about the issue of the same people who set up the barrier for the military buyer.

In addition to being asked to buy good products at the lowest possible cost, members the contractor has with proper consideration in industrial disposal (see page 15) the buyer has other considerations.

It is asked to buy American, buy American and buy efficient. The most important in procurement, moral character and financial responsibility. He must develop multiple sources, save critical materials, observe practices, encourage subcontracting, avoid monopolies, help distressed areas and small business. In addition, there is a mandatory procurement from the General Services Administration and this federal agency.

The trouble was recently defined last summer by Sen. Robert Ferguson (R-Mich.), who will not sit in the next Congress. Said he "Congress has gotten to the point where it never repels a law. It just adds another law on top."

Missile Security Crumbles

Washington observers are wondering how much longer Department of Defense has to go to delude themselves on missile security. Top-level Pentagon officials say better adequate security is being maintained on latest security developments simply because no official public release are being made from its public relations paper wall.

However, Bell's Rural air-to-ground missile has been in public use in Boeing's Seattle Airport and the Navy's F-105, missile in flight, entering a low altitude that carries thousands of tons to the air.

Northrop's South has been pulled as a public airfield at Hawthorne, Calif., used by private plane. Navy's F-105, missile in flight, entering a low altitude that carries thousands of tons to the air.

Non public information on the Carrier Air Force, continued missile security, said sensitive missile project in the Pentagon itself, in looking for external news magazines and club newspapers in the San Diego area.

Air Logistics Bottle

Although big USAF has been tried out in 1954, for the second air logistics conference in Washington (see page 17), the real battle to get USAF supply off the ground and into the air is being fought under the air staff.

Sen. Lee said small aircraft can't make the long haul but the major problem is the carrying of the major products of World War II to the new world. The carrier problem. Aircraft industry and USAF officials of aerial logistics will be watching the fiscal 1956 budget closely to see if air transport will really get some emphasis when it comes to the pocketbook.

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—Washington staff

AVIATION WEEK

VOL. 61, NO. 36

DECEMBER 23, 1954

Aviation Sales Outlook: \$8 Billion in '55

- AIA expects net profits to equal 1954, as deliveries and employment remain stable for fourth straight year.
- Forecast for new year predicts more transports and bombers will be built, missile production will increase.

By G. J. McAlister

Aircraft industry sales of \$7.9-\$8.1 billion are in prospect for 1955, a slight decline from the \$8.6 billion in sales for 1954, Aircraft Industries Assn. predicts.

However, manufacturers can expect profits to remain above the 1955 level and to be approximately the same as in 1954 because of the expansion of the ocean profits tax.

► **Steady Outlook**—This will be the fourth straight year that industry sales have reached or exceeded \$8 billion, an unusually stable level of operations.

That character of the state of the industry—sales, pounds of surplus and employment—will remain steady, although net production will continue to surge off gradually.

► **However, interest, principally in the bomber and transport categories, will be built.**

► **Carded missiles** are taking an increasing amount of the industry's production effort. At least 35 different models are in production, as service test stage.

► **Research and development** continues at a relatively high level.

► **1955 Outlook**—The association also forecasts this outlook for next year.

► **Employment** will continue at a high level, with a 1955 average of 758,800 workers. Shortage of engineers and technicians will not diminish.

Peak aircraft employment in 1954 was 830,100. Average employment from January through September was 810,000, ending the aircraft industry the nation's leading employer. The 1954 average was 53.5 billion lightest in the U.S. and an average annual earnings were \$4,414.

► **Combat capability** will be appreciably increased with the delivery of new high performance models, and by the end of 1955 USAF will be 95% modernized and the Navy air arm 80%.

At the end of 1954, virtually all combat aircraft in production were powered and production had started on seven supersonic fighters and six

supersonic bomber. Fighters are North American's F-108, McDonnell's F-101, Convair's F-102, Lockheed's F-104, Grumman's F-107, Douglas' F-4D and Republic's F-105. Bomber is Convair's B-58.

► **Revelationists** advances in atomic fuel energy have opened an increasing need for increasing research facilities and new equipment. This will create an increasing requirement for this type equipment during 1955 if though production plants virtually have been completed.

► **Civil aircraft** manufacturers at year's end had filled orders for 175 large commercial planes and are expected to continue this leadership in the world civil aircraft market. During 1954, U.S. manufacturers delivered 325 planes of which 195 were 36-seater or larger types and 139 were transport commercial planes.

► **Out production of utility aircraft** in 1955 will be approximately the same as in 1954. The total industry effort will be \$40 million, an increase from 1953 sales of \$34.3 million, and to increase in volume weight from the 1953 total of 12.6 million to 12.5 million in 1954. This is the result of new passenger aircraft being offered in quantity for the first time in 1954.

► **Production of helicopters** for commercial use is expected to increase in 1955.

Military Production

Production of military aircraft over the last of the Korean war in late 1950 is estimated by AIA at \$3,800 to \$7,800 million.

Estimates by year:
1950—Less than \$200*
1951—More than \$300
1952—\$200
1953—\$1,300
1954—\$3,800 to \$7,800
*1,150 million sales from 1949

following steady increases made in 1954: ► **Thunderbolt**—F-100 fighters, including 1954 of the 12 largest aircraft manufacturers was about 33.3 billion, higher than World War II. Sales by these companies in 1955 are expected to approximate the 1954 record.

The end of 1954 marked the transition from the buildup to the combat and modernization phase of the nation's air modernization program. However, production of aircraft weight in 1955 is expected to show the same as in 1954—about 13.6 million lb.

AIA predicts that production of military aircraft for 1955 will be about 10,000 planes. Military deliveries represent about 90% of the total industry effort.

Aircraft industry during 1954 was able to place an increasing emphasis on improving manufacturing techniques and cost-reduction efforts. Prime example of improving the quality and adaptability of products is in jet engines where substantial reductions in requirements became possible through increases of time between overhauls.

NAA Profit Exceeds \$22 Million

Record postwar profit of \$22,179,736 net reported by North American Aviation, Inc., for its fiscal year ended Sept. 30, 1954. The NAA report is a bold statement on the effect of expansion of ocean profits tax in 1954 profits.

North American's sales in record \$22-million profit on sales of \$648,514, 341, slightly higher than the 1953 sales of \$639,517,618 that yielded only \$12 million profit because of the ocean profits tax. The company noted the equivalent of 56.46 per cent for 1954, compared with 57.22 for 1953.

► **\$8.8-billion** backlog—Lee Atwood, corporate president, predicted North American's sales would continue at about the 1954 level during next year. Backlog of \$1,372 million new on the corporation books, compared with \$915 million at the beginning of 1954. NAA noted its 1954 Wm. H. H. pack in close competition with the other, alone \$1,784,000 in, compared with \$8,754,000 in it at the wartime peak.

However, the corporation plans to invest 53% of sales in additional facilities during 1955 to meet increased demand.

development and production loads. Among the new facilities planned is a precision machine shop, nuclear development facility, new general offices and additional to the aerospace headquarters. Total of 56 million was spent for new facilities in 1954.

► **Expansion**—North American's annual report gives a clear picture of the remarkable character of the firm's expanding activities that have changed it from primarily an aircraft manufacturer into an industrial giant with substantial interests in electronics, rocket propulsion, nuclear energy and guided missiles.

Aircraft production still accounts for the major portion of its total sales, of which 54% are in the hands of the federal government. North American's aerospace production is distributed as follows among four divisions:

► **Los Angeles** produces F-86F fighters, F-86D all-weather interceptors and F-100 Super Sabre day fighters for USAF; will produce two new versions of the F-100 series in 1955, including a light-bomber configuration and an all-weather interceptor.

► **Calhoun** produces F-12 and F-13 carrier-based Navy fighters, A-12 and A-29 carrier-based bombers, and F-86F and F-86H fighter-bombers for USAF.

During 1955, F-86D production will begin here, and the Navy's F-2H trainer program will be transferred here.

► **Dayton**, the first major design project of this division, will go into production during 1955 for Navy.

► **Dowry** produces T-28 trainers for USAF and Navy and housed development facilities for missile, rocket and electronic work.

► **Research** completed T-6C modification program and began development program on F-86 fighter and F-56D all-weather interceptors.

In addition to the two new versions of the F-56D now in production, North American also expects to move F-86F production for USAF and is probing the site of a two-place trainer version of the F-86 to both USAF and Navy.

General missile and guidance equipment program at the Dowry Division continued to expand during 1954, and a number of these projects shifted from development to manufacturing phase.

NAA reported new contracts received for development of both missile and rocket guidance systems, a phase of the corporation's expanding activities that has drawn criticism from aerospace manufacturers already established in this field.

► **Rocket Contracts**—North American's interest in rocket propulsion is be-

Gains in 1954	
	1954 1953
Net income	\$25,716 (\$22,773,381)
Assets	\$68,334,514 (\$56,537,618)
Dividend per share	0.46 0.72
Booklet	\$174,000,000 (\$150,000,000)

growing to pay off with the receipt of contracts for large rocket motor for missiles to be manufactured by another company.

► **Practically**, this means North American has at least part of the propulsion contract for the Convair's Atlas missile rocket that is the only recent requirement for the large rocket power plants developed by North American Aviation.

USAF is financing a new rocket propulsion development center to be operated by NAA, located in the San Fernando Valley approximately 10 miles from the company's present test facilities in the Santa Susana Mountains. This \$22,000,000-\$31 facility is expected to be completed during the course of 1955.

► **Nuclear Progress**—North American also will build a new nuclear development center at the San Fernando Valley and transfer this program there from the Broward Division.

The company is working on experimental atomic graphite nuclear reactors at Santa Susana and expects to have it operating by 1956.

► **It is part of a \$30 million program to develop nuclear power sources from which energy NAA has other Atomic Energy Commission research contracts.**

► **Subcontract**—Chicago-North American reported a major shift in the character of its subcontracting activities during 1954 that probably brings a general change in the business relationships of plant expansion review contracts with their subcontracting and suppliers' sectors.

NAA says it has cut down substantially on the volume of subcontracts recently work goes to subcontractors but that it is increasing the volume of subcontracts now placed with outside firms.

► **The trend toward more machining in machine shops** has made it necessary for the company's buildup in machine shops capacity to keep pace with schedule requirements and has led to greater emphasis upon subcontracting in this category, the North American report says.

► **North American** purchase orders total over \$335 million placed with outside firms during 1954, compared with \$308 million during the year 1954.

Air Logistics

- Experts cite combat need for aerial supply system.
- Military, civil spokesmen outline major problems.

By Robert B. Hutz

Air force need for a global aerial logistics system to support USAF, Army and Navy mobile units was outlined by top spokesmen for the military, civilian and aerospace manufacturers at an air logistics conference in Washington sponsored by the Air Logistics Association.

Among the principal problems cited in development of the system:

- Shift in military logistics practices to reflect as a primary method of transportation for various critical material supplies as an increasing emergency.
- Development of 300 mph transport capable of carrying 100,000 lbs. payload over 3,000 mi. range.
- Development of high-powered turbo-prop engines that will make the long-range, high-speed long-haul transport possible.
- Integration of the capacity of the civil airlines fleet into a permanent personnel and aerial logistics system.
- Development of the aerial logistics system during peacetime so that it is in being and operational when required to support combat in extreme warfare.

Talbot Reports

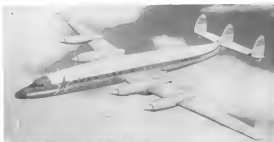
USAF will take another major step in establishing an aerial logistics system now being with the inauguration of tests of all aircraft equipped by its members, USAF Secretary Harold Talbot told the conference.

Talbot said USAF planned to use commercial aircraft operated by civilian crews to augment military airlift on the project (Associated Press, Aug. 16, p. 140).

► **Deceased**—Talbot said "This project provides a good example of the way that can be used in the case of air transport system." Talbot said "We estimate that the time of the engine overhaul cycle will be reduced from 250 days now required by surface transportation to only 100 days in air transportation."

► **We also estimate** our civil engine requirements will be reduced by about 25% in the operation. A 15% reduction in engine requirements results in a good many millions of dollars when we remember that a single 15% cost saving \$75,000, a single 15% cost saving \$75,000, a single 15% cost saving \$75,000.

► **Talbot, Executive**—Talbot and the backbone of the air logistics trans-



TURBOPROP-POWERED LOCKHEED Super Constellation (left's) version has new thin high-speed wing, 27 ft. longer than present model

If It Gets Orders Near for Airline Turboprops . . .

Lockheed Can Deliver L-1449s in 1957

Burbank, Calif.—First airline delivery of Lockheed Aircraft Corp.'s new L-1449 turboprop Super Constellation is expected to be in January 1957, if orders are received.

Prototype of the Super Constellation powered by four Pratt & Whitney PT2 turboprop engines is programmed to fly in August 1956. It is understood Lockheed will turn out an prototype as much but the first three production aircraft of the assembly line will be used at test airplanes, each at Douglas Aircraft Co. with its DC-7C.

CAA certification is expected in March 1957, following first delivery with an X-15 engine in January. Pratt & Whitney-Turboprop also will build a static test aircraft at well as one for pressure tests to destruction similar to those carried out on the British Comet.

The Burbank firm probably will not run the passenger tests in its underseater test, as the British did but will do its testing at the Mojave Desert near Palmdale, Calif., with a minimum well built around the aircraft to protect against structural failure.

"We do not expect any problems whatever of that type," says a company spokesman, "but of course the aircraft will be analyzed on the basis of the Comet shuffles."

The L-1449 is designed to operate at 30,000 ft.

The Lockheed schedule is believed

to call for production at 44 to 50 of the L-1449 by the end of 1957. The company will not bulk production of the conventional 1649C Super Constellation and sales of that aircraft are continuing. Separate tooling will be produced for the L-1449 and the two aircraft will be turned out simultaneously on separate final assembly lines.

•DC-7C: Completion—Announcement of the new turboprop aircraft has not slowed Lockheed's jet transport status, which are continuing.

"That is not offered as a substitute for the jet transport," says Leonard Schwartz, Lockheed's director of commercial sales.

The new turboprop aircraft is considered Lockheed's answer to the challenge laid down by both the Douglas DC-7C with its Wright Turbo Compound engines, and the DC-7D, which may be powered by Buick-Rolls R.B. 109 turboprop powerplants.

With its long range and a cruising speed above 420 mph, the new turbo-

TWA Dilemma: Turboprops or Jets?

Recent flight, empty mid-1940s of Trans World Airlines still a debate about whether TWA will order any of the Lockheed L-1449, an alternative comes across Aviation Week. It was indicated that no decision is expected soon.

Flight is indicated to be around about low cost Boeing 707 jet transport could be put into transportation and some flights, under the TWA's competition of the new turboprop Super Constellation.

Flight knows he would have to pay only as Lockheed's new line if the L-1449 goes into production, and he is inclined to doubt that Boeing can meet the delivery dates of a competing. But he is not to be getting more data on the 707 before making any decision for new high-speed equipment for TWA.

It was indicated again last week that if the L-1449 is not ordered by TWA, which would need about 15 ships, the plane probably would not be built at all.

Meanwhile, other airline owners said they doubt if any language before long or jet transport would be ordered by any airline until the Air Force decides which 418 manufacturers will serve in upcoming military contracts for new jet liners.

Boeing already has received one such order that carries it to be the first American company to place delivery of commercial versions. Otherwise, no commercial transport orders will be released until it does receive the additional military orders.

Any other company such as Lockheed or Douglas also will be in commercial business if either or both were the USAF orders for jet liners anticipated in the near future.

prop transport is expected by Lockheed to offer superior performance to both the DC-7C and 7D.

"Using only normal wing fuel capacity," says the Burbank firm, "the Super Constellation turboprop can fly a distance greater than that of any contemporary turboprop or turboprop transport and corresponding to the ultimate range of any expected long-range transport with a jet engine installed."

With the turboprop engines producing 60% more thrust power, Lockheed new fuel costs per mile will be 15% lower than "the latest commercial airlines use in service" as, in other words, the DC-7.

On the basis of announced figures for the L-1449, which Lockheed believes to be as conservative as the new turboprop engine not only would top the announced performance of the DC-7D but also offer a considerable speed edge over the DC-7D although the latter would be comparable in range.

The new Lockheed camp, together with the dispatch of new orders to a world wide campaign, has brought the sales competition between both American and British aircraft manufacturers to a new pitch.

A number of airlines, including many already committed to the DC-7C, are looking to be taking a close look at the Lockheed proposal.

On the basis of announced figures for the L-1449, which Lockheed believes to be as conservative as the new turboprop engine not only would top the announced performance of the DC-7D but also offer a considerable speed edge over the DC-7D although the latter would be comparable in range.

and economies. That, of course, would depend upon the engine used on the DC-7C.

Lockheed anticipates that the L-1449 will have a lower unit-cost cost than the DC-7C.

The Douglas Series 500 will be well able to replace a jet order from the new Lockheed aircraft, however Pan American World Airways expects to get the DC-7C into service in the summer of 1956, with Trans World Airlines hoping to start operations with the L-1449 in the summer of 1957, if it goes ahead with an order.

Price tag on the L-1449 will be \$2,619,000, compared to \$2,750,000 for the DC-7C.

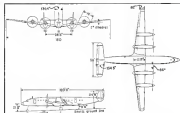
•DC-7C: Struggle—Douglas, of course, has further sharply cut the DC-7C sales to one order to the Lockheed proposal.

Now in the closing hours of Santa Monica is a three-way version of the DC-7C designed for an unexpected turboprop engine that would cruise at 425 mph with 110 passengers. Engines for this might be commercial versions of the Pratt & Whitney T35, Allison T36 or Bristol B.E. 25.

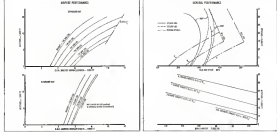
The DC-7D with the R.B. 109 would cruise at about 385 to 390 mph.

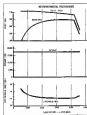
•Single Turboprop—The new Lockheed aircraft could take any of the turboprop engines mentioned above, since they have been proved. The company selected the PT2 because it is a simple and uncomplicated single-prop turboprop that has been under development for years.

"This is the engine for 1957," says a Lockheed representative. The company also looked seriously at the T36, it is reported, but found it would not be available until a year later than the PT2. There will be improvements



THREE-VIEW shows planform and dimensions of proposed L-1449 turboprop transport.





altitude in the turbine section and the gear ratio. A 12% improvement in thrust is its economic curve as a result.

► **PT-2 Highlights:** Features of the 6,000-shp. turbo-prop engine are listed as:

- Steel construction with the outer engine, except the reduction gear housing, made of corrosion-resistant steel alloy.
- Smoothly resulting from single-step design with solid compressor-turbine assembly.
- Low operating temperature that eliminates the need for complicated internal cooling of turbine blades and vanes.
- Reduction gear ratio that keeps the propeller tips in the subsonic range at all times.
- Anti-icing provisions with hot compressor discharge air piped through hot fuel inlet guide vanes and stator at the air intake.
- High capacity capacitor-type ignition system that admits highly stable power.
- Semiautomatic combustion chamber divided into eight segments, each with a start-boost fuel control.
- Engine safety feature that prevents fuel flow to engine and propeller rotation.
- More than double horsepower per pound of weight.

Lockheed expects these engines, mounted on a new five-way, to push its redesigned Super Constellation to a block speed 77 mph. Faster than "any current or forecast piston engine compressor transport" (DC-7C) and 10 mph. faster than "any present or projected piston-engine, transport, commercial transport" (DC-7D).

The 1449 features a simplified four-turbine fuel system with single-point auto-ignition. All fuel is metered within the wing and no tip tanks are planned at the moment.

For other features of the new airliner, see AVIATION WEEK Dec. 6 (p. 17).

Trippe Outlines Air Role in Cold War

vital role of U.S. aviation in winning undeveloped countries as allies of the Free World was described by Juan T. Trippe, president of Pan American World Airways, at Washington's Aero Club Wright dinner.

"It is simple economics that a country cannot develop unless it has a proper transportation system," Trippe said. He added that many underdeveloped countries cannot wait for railroads and highway systems to be developed.

► **Airline Opportunity:** "Geography and political conditions have shown to stop these airliner stages," he said, "and enter directly into the age of flight."

"Expanding and improving the national transportation system of present-day underdeveloped countries represents a great opportunity for American airlines to do service. Its capital and know-how in partnership with local investors, and supported by appropriate medium-term credits beyond the usual capabilities of commercial banks, can measurably strengthen the countries we wish to be our friends."

► **Wright Day:** Other Wright orators now activities included:

- **Collier Trophy** was presented by President Eisenhower to James H. Kashiwagi, board chairman of North American Aviation, Inc., and Edward H. Heinemann, chief engineer of the El Segundo Division at Douglas Aircraft Co. (Aviation Week Dec. 13, p. 11).
- **Wright Brothers Memorial Award** was presented to Dr. Theodor Van Karman by the National Aeronautics Administration (Aviation Week Dec. 6, p. 7).
- **Dr. Lindbergh**, director of Sweden's Aeronautical Research Institute, delivered the Wright Brothers Lecture on "Ethical problems of aircraft."
- **Dr. John H. Forster**, director of Air World Education for Trans World Airlines, was awarded the Bowers Trophy for aviation education activities throughout the world.

At a luncheon preceding the Wright dinner, the following were awarded the Coupe de la Vitesse medal by the Fédération Aéronautique Internationale for speed records:

- **Reg. Gen. J. Stanley Holman**, USAF, for a 103-knot closed-course record of 699.6 mph in a North American XP-55D.
- **Robert O. Kahn**, Douglas test pilot, for a 183-knot closed-course record of 723.1 mph in an F4D.
- **Col. William F. Barrow**, USAF, for a 3-km. straightaway record of 715.745 mph in an F84D.

- **Le. Cmdr. James B. Vrelos**, USN, for a 3-km. straightaway record of 712.945 mph in an F4D.
- **Le. Col. Frank K. Everett, Jr.**, USAF, for a 15-km. straightaway record of 713.182 mph in a North American YP-100A. Col. Everett is the current holder of the absolute world speed record.

The Blount model was awarded to William D. Thompson, Jr., Convair Aircraft Co. test pilot, for establishing a world's altitude record of 37,663 ft. in a lightweight aircraft (one weighing less than 2,504 lb.).

Altitude flight was made in a turbo-propowered Convair XC-119. The plane was powered by a Boeing RB-24 engine.

Hunsaker, Crawford Appointed to NACA

Dr. Jerome C. Hunsaker of Massachusetts Institute of Technology, and Frederick C. Crawford, chairman of the board of Thompson Products, Inc., have been appointed to five-year terms as the National Advisory Committee for Aeronautics.

Hunsaker, a member of NACA since 1915 and its chairman since 1941, was reappointed. Both appointments, by the President, date from Dec. 1 of this year.

► **Navy Plans Designer:** A graduate of the Naval Academy, Dr. Hunsaker has been identified with aviation since 1913, when he was detailed to Europe for a year's study of aeronautical progress there.

The following year Hunsaker set up MIT's Department of Aeronautical Engineering.

From 1916 to 1918, when he left the service, he directed the design of every naval aircraft constructed. Most notable among these were the NC-type flying boats. From 1926 to 1933 he was associated with Bell Telephone Laboratories and then Goodyear-Zeppelin Co.

In 1933 Hunsaker was named head of the Department of Mechanical Engineering and Aeronautical Engineering at MIT.

He is a director of numerous companies, including the McGraw-Hill Publishing Co.

► **Air Foundation Chief:** An electrical engineer trained at Harvard University, Crawford has been with Thompson Products since 1916. He is head of the Air Foundation which sponsored the National Air Races until 1949 and since has sponsored the National Aircraft Show.

Crawford is active in the affairs of the National Aeronautics Association and was responsible for Thompson Products' support of Rens-Woodbridge.

Bleed Air Requirement

Of particular interest is the year the twin turbine configuration of Hydro-Aire's new Propulsion System allows the individual optimization of the refrigeration turbine while tailoring the other turbine to best performance throughout the power requirement range. By utilizing two turbines in-

stead of one, optimum design for refrigeration needs is not compromised for variable power outputs.

► **Works both ways.** Conversely, additional power demand is not produced by energy losses from (1) low through flow efficiency (only the refrigeration

turbine is required to the Heat Exchanger), (2) increased back pressure from exiting warmer turbine exhaust gases (overboard).

► **Net efficiency increases.** The advantages, in both weight saved and lower installed 50 blade jet, are obvious. "We believe Hydro-Aire has made another remarkable contribution to further refrigeration," states Dr. H. Rhoads, President.

*"Twin Turbine Teamwork"
—a New Principle
in the ATM Field!*

Frijadrive®

A SINGLE PACKAGE, COMBINING AIR CONDITIONING AND ACCESSORY DRIVE FUNCTIONS



FRIJADRIVE offers weight savings of 28% to 48% and saves up to 30% in bleed air requirements. It is based on an entirely new principle: Twin Turbine Teamwork.

This principle provides speed control within two-thirds of one second. Auxiliary power requirements are very low, from zero to maximum horsepower. At the same time it supplies a constant air conditioning flow to the cabin.

A control system compensates each of the two turbines as required, thus automatically proving optimum efficiency at all times for both auto-ventilating and recovery-dry functions.

We'll be most happy to meet with you and show you exactly how it's done... and what FRIJADRIVE can do for YOU. Call, wire or write for the complete story NOW.

Every fighter, every bomber, every transport, every ship is Frijadrive equipped.

HYDRO-AIRE
—the world's leading turbine unit—

for

The Aviation Subindustry

CRANE Co.



Spotwelding .240 75st Aluminum Stringers to .081 75st Clad in Wing Section on F-84-F

These heavy section stringers are a Republic design improvement in wing structure of the battle proven F-84-F Thunderjet. This instance of improved design with resistance welding is not an oddity—Republic design engineers are specifying five times more resistance welding in wing assemblies and three times more in fuselage assemblies than ever before.

The advantages of resistance welding in both surface and jet engine fabrication are well known. Aircraft and Military specifications are most easily satisfied and maintained by Seiki's patented Triax-Phase welders. That's why approximately 98% of all the resistance welding in surface fabrication is done in Seiki machines. Write for Bulletin 124ST for information on Seiki Type ST aircraft welders.

The Seiki Type ST welder shown above is one of many at Republic proving in daily production Seiki's basic thinking of resistance designs to do more useful work at lowest operating cost with maximum reliability.

Largest Manufacturers of Electric
Resistance Welding Machines in the World

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IMPROVED TRAFFIC FLOW is expected when present air route control centers (left) get new facilities (right), including language radar.



PROJECT VOLCANO, AF's automatic air traffic control made up of radar (left) and computer plus display (right) calculates flight paths.

Report on ACC Project:

Civil-Military Navaid Progressing

The language program to improve the Command System of civil-military air traffic control and navigation is showing substantial progress, reports Robert Murray, Command Undersecretary for Transportation and Air Coordinating Committee chairman.

The study is being made by a special ACC group composed of government and military representatives. Plans under consideration are:

- A potential presentation of air route control centers of plans compute on the airways.
- Combining air defense and civil radar systems.
- Increasing range and speed of long-range surveillance communications.

► **Radio Control**—Present system of plotting air traffic involves complicated communications and coordination between controllers. Various aircraft positions, altitudes and speeds are written on strips of paper and passed from one controller to the next during the process.

The ACC group is working with the Civil Aeronautics Administration's Technical Development and Evaluation Center on a radar map-plotting display that enables controllers to see aircraft in their progress along the high-density airways.

Large plotting tables and horizontal long-distance radar show aircraft positions mostly in the east as they depart. This enables the controller to prevent collisions while directing incoming numbers of aircraft.

► **Direct Communication**—The ACC group is making every effort, Murray

says, to integrate available civil and military radar with the special air defense network and other military radar to improve the volume and safety of air traffic control.

A successful integration "could save millions of dollars in future appropriations for new expanding systems," he adds. "It may also provide the language radar component of the command system."

Previous for direct radio telephone communications between pilots and controllers is under way, ACC reports.

► **Volcanic Difficulties**—As an example of increasing civil-military cooperation in development of a common system, Murray cites the report by Air Force Undersecretary James H. Douglas to have ACC evaluate "Volcanic." The ACC group noted Volcanic in operation recently and approaches of 30,000 knots were demonstrated.

The group's preliminary investigation revealed certain operating difficulties concerning the use of Volcanic in the common system," Murray says. "Evaluation may reveal the possibility of downgrading these..."

*Stainless Steel BT-12 Bomber Trainers
Powered by a Pratt & Whitney
405 hp engine, the BT-12 had a top
speed of 188 mph, cruised at 145
mph, climbed at nearly 600 fpm*



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KAISER METAL PRODUCTS, INC.
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IN THE HEART OF THE DELAWARE VALLEY

Bell Chairman Sells 10,000 Stock Shares

Disposal of 10,000 shares of Bell Aircraft Corp. common stock by board chairman Lawrence D. Bell is reported by the Securities & Exchange Commission for the period of Oct. 11 to Nov. 10. Chairman Bell's common stock holdings now total 1,800 shares.

Other aviation industry transactions:

John Huggins 1949 Inc. Disposed of 500 common shares by Henry A. Huggins, president, for \$100,000. Huggins 1949 Inc. is a subsidiary of Huggins Aircraft Co., Inc., a subsidiary of Huggins Aircraft Co., Inc., a subsidiary of Huggins Aircraft Co., Inc.

Shaw-Walker 1949 Inc. Disposed of 500 common shares by Paul C. Walker, president, for \$100,000.

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We honestly believe we can offer you the finest Air Data Computers that money can buy.

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And here, for example, are two big problems we've solved. E-P Air Data Computers are now capable of:

1. Correcting for probe position error as a function of Mach number.
2. Operation up to an altitude of 150,000 feet.

Beyond all this is an unmatched team of designers, engineers and fabricators who . . . by training and by experience . . . are specialists in fine precision instruments. They are the secret of our latest Air Data Computers that weigh as little as 12 lbs., occupy only 350 cubic inches (including power supply and amplifier) . . . and is capable of delivering all the functions demanded by modern, high-performance aircraft.

Why not put all this experience to work for you?



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Safety Record

All-time safety and traffic records for U. S. airlines in 1956 are predicted by Civil Aeronautics Board. CAB estimates for the year indicate a record low passenger fatality rate and a record high number of passengers carried and passenger miles flown.

The safety forecast is based on records to date and on statistics to the rail of the year. It shows a passenger fatality rate of 0.04 per 100 million passenger miles for U. S. scheduled carriers, domestic and domestic air carriers—a record low.

Large U. S. airlines air carriers have operated without a single passenger fatality up to the present time. According to CAB estimates, the new decade will carry about 490,000 passengers approximately 1.3 billion passenger miles in 1956.

CAB expects scheduled domestic, foreign and territorial airlines to carry 18 million passengers and 56.21 billion passenger miles. These estimates are based on actual figures for same months of operation.



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Kawneer aircraft products...at economical costs...delivered when and where you want them, result from a Kawanee policy successfully demonstrated many years since we first developed streamlined steel tubing during World War I. Now, in a new plant with new machinery and equipment devoted exclusively to production of airplane assemblies and detail parts we can implement our policy even more efficiently.

We invite inspection at your convenience. But if you cannot visit us, we'll be glad to send you our illustrated booklet or have a representative call on you.

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Building Aircraft Divisions by Kawanee, Inc.

AIRCRAFT
PRODUCTS
DIVISION

UNDER PAINT, FABRICATIONS BY METAL WORKING ALUMINUM AND ARCHITECTURAL DIVISIONS

acquisition of 1,000 common shares by James B. Johnson, director making a total holding of 5,100.

James Stewart Co. Director of 600 common shares by Charles W. Graham, officer and director making total holding of 84,200.

Cardinal-Wright Corp. Acquisition of 800 common shares by H. E. Stewart, Jr., officer making a total holding of 100.

Business Air Lines Inc. Acquisition of 200 common shares by Raymond Proctor, Jr., director making a total holding of 700. Acquisition of 100 common shares by the General and Co. making a total holding of 100.

Travelers Express & Airplane Corp. Acquisition of 100 common shares by William Preston Lane, Jr., director making a total holding of 700. Acquisition of 100 common shares by F. Eugene Stewart, Jr., officer making a total holding of 700.

General Investment Corp. Director of 600 common shares by Charles H. Hager, officer making a total holding of 1,000.

General Electric Co. Director of 600 common shares by William C. Reynolds, officer making a total holding of 1,000.

Lois, Inc. Director of 1,000 common shares by William F. Lane, director making a total holding of 40,000. Acquisition of 1,000 common shares by William F. Lane, director making a total holding of 1,000.

Lockwood Aircraft Corp. Director of 600 common shares by D. E. Brown, officer making a total holding of 1,000.

United States Aircraft Co. Director of 1,000 common shares by L. W. Wainwright, officer making a total holding of 1,000.

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R-652 actuates the tailwheel power steering installation in De Havilland of Canada's DHC-3 Otter

The R-652 operates at 30 rpm of maximum steering torque of 1000 lb. is Overhead air clutch equipped to this in 1000 lb. in. Magnetic clutch with hand read must load with 12 volts a.c. as pilot. The R-652 weighs 400 lb.



Drawing courtesy of The Aviation Journal of Canada, Ltd.

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ROTOLON

Airborne's R-652 rotary actuator supplies the lightweight towing control both pilots need to fly the Otter in and out of makeshift strips in Canada's rugged north. On landing and take-off, the pilot engages the actuator, which locks the tailwheel in phase with the rudder. The R-652, mounted on the tailwheel spindle, has proved as sturdy and reliable in service as the Otter itself.

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AERONAUTICAL ENGINEERING

Time is the most important commodity in engineering the techniques of saving it are varied and ingenious, because time equals money, minutes, seconds—and progress.

One area where the importance of time has been demonstrated is in testing. Adequate testing of any engineering subject produces quantities of raw data which must be kept, processed, reduced to useful form, analyzed and tabulated before being of any real value.

Here is one significant approach to time-saving in windtunnel tests: automatic data reduction. With these new schemes of electronic reading, reduction and tabulation of thousands of data points, time between tests and results is reduced to a matter of

minutes rather than weeks at formerly took.

The Concor system described here is from material furnished by R. J. Volke, chief of their aerodynamic windtunnel, and M. G. Wade, assistant research group leader.

More information on other successful systems can be found in two AGARD Memoranda "Methods Used by NACA for Data Reduction," by H. H. Abbott of the National Advisory Committee for Aeronautics (AGARD AG-3/M2) and "A Scheme of Automatic Data Reduction for Windtunnels," by K. V. Dipone, of the Mathematical Services Department, Royal Aircraft Establishment, Farnborough, England (AGARD AG-9/M5).

Data Digesters Speed Windtunnel Tests

One major drawback in windtunnel testing—the time delay between the test and the availability of processed data—is eliminated by automatic data reduction equipment. Such a system, installed at the Delaware Aerophysics Laboratory, operated by General Dynamics Corp., Dayton, Ohio, has been in constant use since 1959.

An example of time saved: A recent supersonic range delivery test recorded about 15,000 pressure data points. These were automatically recorded on IBM cards and were ready for computers with almost no time lag. Up to the old procedure of photographic processing, reading, proofing and verifying, it would have taken nearly 113 minutes to process the data to the point where computations could proceed.

The notion of OAL was first tested in 1955. It is based on the conversion of strain gage voltages to digital information which is utilized to supply information through an IBM card program calculator for computation.

► Use of the Tunnel—The major effort of the OAL windtunnel is development testing of supersonic guided missiles for the Navy Bureau of Ordnance-Ballistics project. The facility is owned by Naval Ordnance, and it is operated by Concor for them. Additional work on the tunnel is done by contractors to the United States Air Force and the Navy Bureau of Aeronautics.

Many numbers between 125 and 250 are available for testing models

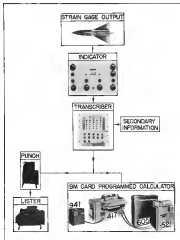
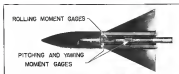
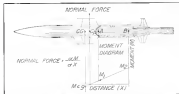


CHART SHOWS FLOW of information in Concor's system for the automatic reduction of windtunnel test data.



CETAWAY MODEL shows typical free-component strain gage sensor balance installation.



TYPICAL continuous panel loading around model in wing of continuous structure.

of structures and airplanes. Instruments here, developed at OAL, records such component force data simultaneously, and automatically reduces the data to aerodynamic quantities.

Concor measures aerodynamic forces on the model with free strain gages, each comprising a full bridge circuit. These gages indicate the stress due to loading measured in the cantilever beam represented by the model. Knowing the moment at two points on the beam, the internal force can be found by means of the slope of the moment curve. Accuracy is increased by placing the far end of gages as close as possible to the reference point about which moments are measured, for most models this is the center of gravity.

The figure above shows a typical strain gage internal balance installation, set away to show the relative position of the gages. The strain gages are separated in a short length of continuous cross section where suitable mounted strain gages can be used to measure the rolling moment inside the model. The purpose at OAL is to measure drag with an external, constant roll indicator balance which supports the internal balance. These balances are also instrumented to measure rolling moment when it is measured in other the continuous section. Output voltages from the strain gage bridges are fed into the main control panel.

► **Information Flow**—The block diagram on page 26 shows the flow of information from the model until it comes out in aerodynamic data. Six digital indicators are used, each with four channels, thus it is possible to measure six components simultaneously in each of four groups for a total of 24 parameters.

The indicator reads the voltage output from the bridge, and produces a voltage of equal magnitude and opposite sign. This voltage is balanced by means of a zero-driven potentiometer, which is a potentiometer. The resulting balanced output operates data for a visual unbalanced indicator of the signal and also runs up electronic circuits in the transducer section. Secondary information is fed into the transducer by the use of an IBM manual keyboard; the signal indicates model air speeds, nondimensional stagnation pressure and the run number. Model angle of attack, a potentiometer fed in.

The digitized information passes through the transducer to the punch where the data are recorded in standard IBM code. After the cards have been punched, the next data are held.

But before punching, the raw data are loaded in the card and converted to decimal notation when it is loaded to aerodynamic data in coefficient form in the programming unit the computer

calculates the difference between the three gage reading obtained, static load and the reading under zero load. These data are now stored until called for in subsequent computations. All computing is done by the 415 and except for small additional adjustments.

Final answers appear in the 417 unit, and are then passed to the punch for recording on cards and also tabulated in the 417 unit.

Computed coefficients are generally obtained within 20 to 25 seconds after the system is assigned. They may be printed in one or two systems of data together with angles of attack and velocity corrected by deflection of the model support under load. A wide variety of aerodynamic parameters may be computed on the spot, and an available automatically to act as to verify accuracy of the test program.

► **Accuracy**—A digital computer theoretically introduces no inherent error in the method used, and therefore the resulting values are as accurate as the information supplied. Thus the accuracy of the whole system depends on the accuracy with which the strain gage voltage output can be read.

For most tests at OAL, normal force can be measured to ± 0.2 lb, and pitching moment can be determined to ± 0.5 in. lb. These figures compared to approximately $\pm 3\%$ and $\pm 0.5\%$ of the maximum loads generally encountered.

► **Other Systems**—OAL has used both digital and analog data reduction devices, and they feel that from their experience, the analog system is best for the continuous testing of non-linear windtunnel data.

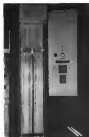
The aerodynamic data may be in instantaneous and continuous form of wing bending moment as a function of the roll attitude of a model at a constant angle of attack. Concor can do the simplest form of analog computer, combined with a modified plotter, will continuously record the load of information as the model is rolled. A typical example of a continuous recording of aerodynamic data is shown above, for the right wing of a cross form wing body combination with the wing horizontal when roll angle equal 0 deg.

Engineers believe that further development of continuous continuous recording equipment will provide valuable tools for exploration, windtunnel tests and the means to define regions of non-linear aerodynamic characteristics.

► **Present**—Virtually all data is being reduced at present manually at various points in a windtunnel model have long been a problem of many people. Normally, personnel use photo-reduction devices, or a camera aimed at a specially designed and lighted stage on one board. This gives actual visual



Adman electronic equipment for the Super Constellation.



Adman unit photograph for automatic, speedy recording of manometer readings.

tained here, because data can be taken as fast as the manometer stabilizes.

But it still takes an excessive number of manometers to read the photographs, transcribe the pressure, or the table, verify the readings and then reduce the data. Operator fatigue, caused by long hours of reading photographs, enters into these computational techniques.

Recording Manometer-Experiments at DIAL have developed the Adman (analogous digital) recording manometer. Using a photoelectric cell, Adman automatically records pressure in digital form so that the IBM equipment can be used to reduce pressure data simultaneously to the required aerodynamic parameters. Each tube on the manometer board is scanned by a photoelectric cell and the pressure reading, from a coating mechanism is stored when the light beam of the cell passes the resistance of the tube. A counter reads the nearest tenth of an inch.

The automatic board at DIAL is a 30-tube electronic model, but is frequently used during regular testing operations.

Pressure are immediately punched on IBM cards and tabulated in the same manner as the strain gage data from flow tests. The pressure data are also handled in the computer in the same manner.

Defence Testing Center has the most notable use of this automatic recording manometer in its testing operations. Difficult far ranges, where the data include the average total pressure recovery, air flow and external and internal drag characteristics.

A large number of pressure are involved in data collection, and compar-

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Standard Actuating Cylinder—1000 psi
1 1/2" bore x 1 1/2" stroke

When a manufacturer gains the reputation of being a primary source for any product, it is usually indicative that they have the "know how" and facilities to produce at competitive prices.

The ability to produce the smallest to the largest, the simplest to the most complex cylinders has made Loud top source for high quality—low priced units.

In addition to making the ordinary actuating cylinder, Loud produces units containing integral mechanical locking devices, snubbing cylinders, power control booster cylinders, as well as a patented mechanically locking cylinder adaptable to many applications where the load is required to be firmly held without pressure and yet easily unlatched and moved hydraulically or pneumatically.

Adman, Record Cylinder—1000 psi
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Power Control Cylinder—1000 psi
1 1/2" bore x 1 1/2" stroke

Power Control Cylinder—1000 psi
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Power Control Cylinder—1000 psi
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tion as so complex that different tests are generally run by taking data at predetermined points over a wide range. This frequently results in increased testing time and taking redundant data in order to bracket the critical ranges of the various parameters.

The use of the automatic recording manometer means that the necessary computations for each point can be completed in about 10 sec, and the test engineer can quickly locate a proper range to investigate.

This pilot model automatic manometer was built originally to evaluate the problems associated with such equipment and to evaluate the accuracy, reliability.

Calibration tests conducted recently showed that 95.2% of the pressures recorded were within a 0.1 in. mercury of the correct pressure, which is the design accuracy of the measuring equipment.

A final working model developed at OAL will have 60 tubes reading to the correct half tenth of an inch and this will service 85% of the pressure testing requirements at the Douglasfield test laboratory.

Computer Results Shown in 'Window'

A new device can usually display the results of digital computer calculations on cathode ray tubes, eliminating the previous methods of printing out such results.

Developed by International Business Machines Corp., the device can put computer results in the form of graphs, geometric figures, engineering symbols, or words and numbers. It is called the Type 746 CRT Output Recorder, and is designed for use with IBM's Type 701 and 704 computers.

If the computer is working out an engineer's flight path, this screen can be displayed graphically as the 746's 23-in. CRT. If the problem is to determine the shape of a cone, this too can be displayed visually. The size



WORKS ON PICTURES on recorder's tube set by info show complex output



Being capably rolled out of 1000th B-47, covered with their enthusiasm is a charitable organization.

The 1000th B-47 comes off the line

In March, 1958, the first production B-47 rolled out of the Boeing plant in Wichita, Kansas. On October 14 of this year, the 1000th Boeing-built B-47 came off those same assembly lines.

The Boeing B-47, also being produced by Douglas and Lockheed, is the Strategic Air Command's first low, high-altitude medium bomber, and is capable of carrying a nuclear weapon 10 miles a minute. Already SAC's Second Air Force has been

completely equipped with B-47s, making it America's first all-jet striking force. Additional SAC units are in the process of making the same transition to jets.

Boeing's Wichita Division has, from the first, carried out continuing programs to lower production costs and to maintain on-schedule deliveries. The advanced B-47 is now being produced with fewer man-hours per pound than were required for the

much less complex B-29 during World War II. As a consequence, the cost of the B-47 has been reduced well below the best original estimates, and cost-cutting savings have been passed on to the government.

Today, leaders building B-47s, the Boeing Wichita Division, is looking up at a second outstanding source of the B-52 eight-jet heavy bomber, which is now in production at the Boeing Seattle plant.



This symbol is right at the heart of the Boeing Air. It stands for strength and global achievement. It is found on each Boeing plane on the B-47, B-52, B-66, B-70, B-71 and even on the B-747.

BOEING

information is also displayed on a small 7-in CRT which can be photographed by a 35 mm camera.

The new recorder can display computed data points at the rate of 8,000/second, providing output speeds comparable with the computation speeds of the 700 and 704.

Accuracy of the visual display is within 5% on the larger tube, and is within 0.1% on the small scope, according to IBM.

By using variable programming techniques, the CRT display and the operation of the scanner can be controlled automatically from the computer itself, IBM says.

Franklin Tests New Supercharged Engine

Tests are being made in a test-dive island, FH-119 (2-52) helicopter of a new Franklin supercharged engine and to deliver 180 hp from an level to 3,000 ft altitude.

Engine and turbocharger have successfully completed official military qualification tests, Aerojet Motors, Inc., Azusa, N. Y., reports. The prototype is also adaptable to vertical installation with minor system changes.

The new engine, designated CH33-

15, is a development of another Franklin engine recalled recently, the CH33-2 (Aircraft News Aug. 21, p. 24).

The turbocharger, designed and developed by Aerojet Motors, will operate 90% of maximum absolute pressure at the compressor inlet up to 50,000 ft., although the engine at present being only within this limit to 30,000 ft. The turbo in its present form can be adapted to engines up to about 400 hp, and with modification, can be fitted to 200 hp class engines.

It features a novel disc-type, backward sloping impeller and a single stage axial-flow turbine wheel having cut Helix blades. Blades are streamlined, twisted and hollow. They are welded to the turbine exclusively at a single point turbine hub by an automatic shielded arc process. The turbo operates at 34,000 rpm, with maximum allowable gas inlet temperature of 1,625°F.

A regulator, developed by Edgemoor Division of Bendix Aviation Corp., is designed to limit the supercharger's maximum speed and to maintain, at any altitude the manifold pressure selected by the pilot. It operates independently on engine oil pressure and actuates throttle and exhaust gas waste gate.

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A series of non-technical reports on research and development in aircraft design and operation has been made available by Flight Safety Foundation. The abstract copies of the reports, written in 1957. Single copy prices are given. Prices for quantity orders are available on request. Address: Flight Safety Foundation, Inc., 471 Park Ave., New York 22, N.Y.

• **Protective Design in Forward and Rear end Impact Tests in Transport Aircraft**. Document of the continued topic. Hugh De Haven, Dutch Injury Research. SAE paper 6 pp. Jan. 1957. Price \$24.

• **Turbulent Flow in Air Transport**. Excerpt from 143 Wind Tunnel Series, Dec. 1952. William L. Lifford, Aero-Aeronautics. 15 pp. Price \$14.

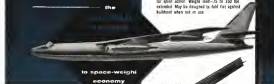
• **Survival of Accidents**. Progress in the Field of Aviation Safety. Second annual supplement. Listings of 1120 projects in various fields including action on completed projects. General Organization Aviation Safety Center. 198 pp. Jan. 1973. Price \$1.00 (Oct. #19).

• **Research and Development to Promote Safety in Aviation**. Summary of current design and operations and suggestions for additional research. Dec. 7 '72. Wright 542 Report. 23 pp. Sept. 1970. Price \$14.

• **Aviation Progress and Safety Should Share Hand in Hand**. Progress and vital studies of improvement in safety studies. J. Lott, SAE paper 6 pp. March 1971. Price \$24.

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From design to delivery by Universal for Boeing's Boeing for industry or government meeting all requirements or standards for use "open throat". A close tolerance, complete steel metal fabrications of complete parts incorporating 1000 steps and triggered spring action. Contributing to complete slide reduction, the slides operate on ball-bearing rollers built to 1/1000th for great accuracy. Weight load—75 to 150 lbs. extended. May be designed to hold fast against buckling when not in use.

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Designed for mounting of lights or equipment from slide forward and back. Three steps, precision, mechanical sheet metal construction in complete parts, stamped with slides and steps to govern the length of travel separating on ball-bearing rollers to 1/1000th the tolerance of tapered roller. Slides are 35 inches long, telescoping and extend 16 inches, accurate loading 250 to 250 lbs. extended. 30-ton capacity. May be constructed by UNIVERSAL from existing tooling.

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nothing you dismay
Remember that the H-bomb is
delishious today
There's not one vapor problem. Who
is carrying it which way?
Oh, tanks of comfort and joy, me,
me"

"Oh, little town of Bethlehem, how
still we see thee lie!
Above thy troubled, endless sleep the
stars have been dimmed by
The star that led the shepherds is a
navigator's guide.
The wise men are in hiding, but there
is no place to hide"

"Hark the herald angels sing
Bigger bombers are the thing
Peace on earth they guarantee
By H-ability
Joyful, all ye nations rise,
Clave us loaves for our price.
So that we may better be
Pleased to strike back nastily
Hark, the Air Force angels sing
Bigger bombers are the thing!"—ODA



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PRODUCTION BRIEFING

► **Schedule delays on Northrop Air craft**, Inc.'s production line are now substantially reported to a critical extent due to status of Teletypegraph system, the automatic method of transmitting handwritten communications commonly used in banks, hotels and other businesses. Listed transceivers are installed at 17 stations, with the system capable of handling up to 68. The Hawthorne, Calif., plant has reported backlog to wait up to \$175,000 monthly.

► **Raytheon Co., Van Nuys, Calif.**, has ordered a 15,000 sq. ft. building to house its expanding Weapons Systems Division. Approximately 190 engineering personnel will be assigned to the computer-aided building to work on high-speed, high-precision, plastic aircraft and guided missile projects. The firm has built more than 40,000 missiles in part of its eight-acre campus.



SAVINGS of five man-hours a day are being made at Texas Aircraft Corp. by applying a replaceable seal that acts both as a "gasket" and as a sealing plastic disc. The sealing prevents moisture, trapped in the plates, from seeping into flexible printed plastic. Coding a Delta Chemical X-2000, normally used in printed sheet aluminum during bonding, heating and casting.

► **Aerovox Corp., New Bedford, Mass.**, has acquired Henry L. Cowley & Co., Inc., West Orange, N. J., makers of power units and electronic products used in electrical and electronic applications.

► **Bendix Forebodies** is now name for former Raytheon-Pratt Forebodies Division, Torrington, N. J.

► **Chicago Aerial Industries, Inc.**, is new name of former Chicago Aerial Survey Co., Chicago, Ill., in accordance with its expansion of research and production in aerial photography and other scientific equipment.

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| 4) Heat stability | 14) Surface finish (metal) |
| 5) Soluble extract ratio | 15) Thermal stability |
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Around the clock, dependable Sikorsky helicopters now provide new speed, safety, sickness-free comfort and high availability in the transportation of operating personnel between the mainland and offshore stations.

The pictures on these pages tell the story. They illustrate the smooth "high road" to offshore drilling barges in the Gulf of Texas and Louisiana.



2. **S-51 HELICOPTER**, loaded with offshore crewmen, takes off from the helipad on a barge 48 miles offshore, parking 1st.



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Offshore Drilling Barges

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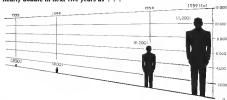
4. **CONVERTED** CUY with flight deck aft easily accommodates the big Sikorsky helicopter. More and more ships and rigs are being equipped with such helipads. The helicopter eliminates the need—and cost—of sturdy safety boats at drilling rigs.



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Airframe firms' employment of avionics engineers will nearly double in next five years as . . .



Battle Over Avionics Dollar Sharpens

By Philip Klaus

The established avionics industry, already rearing into increased competition from within its own expanded ranks, faces the prospect of even more competition from those aircraft manufacturers, particularly on the West Coast. Only the intensification of this challenge remains open to conjecture.

Within the past few months, large avionics systems manufacturers have often found themselves in direct competition with aircraft firms in one instance, North American Aviation but not the field to get a contract to produce the E-6A control system for a new McDonnell-Douglas stealth fighter (Aviation Week Nov. 1, 1983, p. 6).

Surprisingly, Radio Corporation of America, itself a major avionics producer, is a subcontractor to NAA on a portion of the system.

In the field of consoles, where avionics companies are already doing a much higher percentage of the console work themselves, there is much greater cause for concern, according to the specialists in one large avionics firm.

■ **Up and Going Higher**—It is not hard to find the basis for the new competition. Aircraft manufacturers now can play more than 6,500 avionics engineers, a figure expected to top 11,000 in five years, according to an exclusive Aviation Week survey reported here last week. More than costed out of these engineers are engaged in in-house avionics research and development, the survey indicates.

The trend toward giving aircraft man-

ufacturers more responsibility for avionics systems design, procurement, and integration, which has been called back by revisions to the USAF's original Weapons System Management Plan (Aviation Week Dec. 7, 1983, p. 42) may gain new steam from recent Navy moves.

Douglas Aircraft, which had been given a major avionics responsibility for the A-6D, reportedly has been given similar responsibilities for a new Air Force An-600 carrier. At the same time, North American Aviation, reportedly is assigned

to build its own airplane under a similar management.

■ **Triple Threat**—The challenge to the established avionics industry comes on three fronts:

- **Systems engineering**
- **Equipment fabrication**
- **New competitive devices** coming out of in-house R&D activities.

Systems engineering traditionally has been the responsibility of the larger avionics manufacturer, a responsibility which many of them believe they must hold to secure proper system performance

under systems engineering responsibility is not in itself a significant source of income to such a manufacturer. However, it enables him to specify system components which are carefully designed for compatibility, and usually at his own manufacturer's expense. Fabrication of these components and subassembly is the major source of his income.

■ **Two Big "Ifs"**—If aircraft manufacturers take over more and more of the systems engineering for such things as radars, guidance, and fire control on avionics systems manufacturers may stand less chance of getting the contract for all portions of the system. That is the case if the avionics manufacturer is not willing to let control systems for example, develop to meet individual needs for the radar, the computer, and the autopilot.

If, in addition, aircraft companies set up to manufacture avionics subcomponents themselves in some large design firms or at least a pilot-line basis, the threat is compounded for the large avionics manufacturer and becomes a matter of concern for the entire sector as well.

Aviation Week's survey shows that more than 2,000 avionics engineers are required to produce each of the four to five aircraft R&D in a typical aircraft R&D. It is a logical to expect this stable effort to produce new, increasingly diverse and sophisticated systems which will continue to demand considerable products and design and development by established avionics firms.

■ **A Few Examples**—Here are a few of the avionics systems developments, some of them new in limited production, which are already producing much competition:

- **Autonomous navigation computer**, completely self-contained, developed by

Whose Avionics?

Avionics manufacturers are beginning to make what some observers believe are significant inroads into avionics system research and development. A few are already in multiple production on certain avionics radars and sensors, particularly in the cockpit mode field. There should be considerable growth in avionics engineers as expected to reach double in the next five years.

In this regard of their wider avionics work, avionics engineers, Philip Klaus, reports the details of some of their activities into the avionics field and the manufacturers that prompted them. He also reports the problems of future expansion by the avionics manufacturers in this field.

Radio Avionics as an outgrowth of its earlier missile program.

- **Autonomous search radar**, developed by Convair for a point defense contractor, a new in-flight production.
- **Fire control system**, including radar, computer, and target, designed and fabricated by Glenn L. Martin.

■ **Autonomous heading system** for carrier-based aircraft and helicopter autopilot developed by RAI Avionics Co.

■ **VHF communications set** and other radar set developed by North American's Defense group.

■ **Characteristics analysis** by tube, developed by Convair, and now being produced for an defense applications (Aviation Week Nov. 15, p. 7).

There also have been recent announcements of developments in the electronic instrumentation and data re-

search field by Boeing, Chance Vought, NAA, and others. These should undoubtedly be many more disclosures of new avionics developments if it were not for security, since most of the avionics industry's R&D goes into missile programs (45% for missile versus only 20% for aircraft).

■ **How It Started**—It is doubtful if any of the aircraft manufacturers, excepting possibly Douglas, actually moved into the avionics field with the idea of product diversification. Most of them got into the field after that way as a result of missile contracts, which involved considerable avionics work for navigation and control.

The missile field was in view that there was few, if any, suitable substitutes for major components available from avionics manufacturers at off-the-shelf prices. This, coupled with the need for very close integration of missile avionics, pre-engineering, and a variety of other avionics companies with missile contractors to start building up their avionics staffs in some instances, usually required expansion only to do system integration work later branched out into in-house developments.

Shortly afterward, the numbers and complexity of avionics equipment used in jetted aircraft began to grow, and with it the need for integrating all such equipment and avionics into an effective weapon system. This added impetus to the trend which the missile programs had started.

■ **Todd's Philosophy**—The Glenn L. Martin Co. probably speaks for a sizable portion of the avionics industry when it went up its operating philosophy this year.

"Many firms believe that the

Typifying competitive threat posed by airframe



CONVIAIR

companies to established avionics manufacturers are these scenes at . . .



NORTH AMERICAN AVIONICS



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Engineers suffering from the drag of routine assignments and lack of proper facilities are welcomed to discuss with us the opportunities for professional growth and advancement available at McDonnell.

Currently needed are: aerodynamicists, thermodynamicists, designers, stress engineers, dynamicists, flight test engineers, missile electronic engineers, industrial illustrators and artists. For further information, write:

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best overall airborne system will result when the electronic equipment is designed by electronic engineering specialists working side by side with other engineers in the aircraft industrial field. The creation of the electronic department (at Dayton) further emphasizes the recognition of electronics as one of the basic sciences contributing to the design of airborne products.

Industry Concern—It is little wonder that pains were taken from some quarters of the services industry last year when the USAF first announced its Weapons System Management Plan, which aimed toward making the airborne environment "mission ready."

Since then, there have been resolute (AF Reg 70.9), plus accounting, with some from USAF officials, such as that of Brig. Gen. Fred B. Wood of the Air Research & Development Command.

Speaking in New York last spring, Wood said it is "one of the basic tenets of Air Force policy . . . to avoid building up, at public expense, a capacity on the part of the weapons system contractors to compete unfairly with other established industry" (Aerospace Week May 28, p. 42).

However, this is not something about airborne manufacturing building up systems capabilities at their own expense to compete on even terms, or to handle various engineering problems on a case-by-case basis. The latter can frequently occur in search of an adequate replacement in the avionics business, as it has at Ross, Convair, North American, and probably elsewhere.

How Airman Grow at Ryan-Ryan Associates, whose parent company has been in the business for 55 years, is an excellent example of how the development of a new or improved technique for a missile program enables a company to get its feet in the avionic door. Ryan's backlog includes programs for:

- Automatic navigation computers.
- Missile guidance.
- Helicopter hovering control for anti-submarine warfare.

Ryan got its start in the avionic field about five years ago as a result of guidance techniques developed primarily for its new dehydrated Puchard (jet-in) missile. Because of security laws, Chas. Olds, chief of Ryan's avionics group, can only say that this was "an old technique made practical by new laws here" (This is believed to refer to improved concepts in Doppler-type radar).

By applying these techniques to a navigation computer for guided aircraft, Ryan has come up with a completely self-contained device which reportedly gives a pilot a continuous indication of his latitude and longitude and enables him to fly to any point

FLIGHT TEST FILMS OF NEW DUAL PISTON EJECTOR

Place, North American F100

Place, Edwards Air Base

Date: June 30, 1953

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First to design, develop and manufacture cartridge-type ejectors for "force ejection" of external pylons stores for production USAF aircraft.



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Quicker installation and easier maintenance . . . important plus-factors for airborne electronics equipment are a reality at Air Arm. The basic Air Arm approach to all electronics problems, combined with inherent ingenuity and capability, has led to concepts such as pallet packaging, encapsulated and functional circuitry, built-in test points . . . to mention just a few.

Applying these concepts to all Air Arm systems gives outstanding features . . .

- 100% accessibility
- compatibility with aerodynamic design
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MAINTAIN, pointed units and other proven developments for weight and size reduction are a basic part of the new packaging concepts. Electronic circuits are physically combined and integrated into compact subassemblies—each of which has a single major function. Thus, over-all packages are made up of functional units of complete systems.

This "package-engineering" results from intense Air Arm development and close Air Arm cooperation with the special problems of airframe design and operational requirements. Such achievements in electronic-mechanical design are typical of Air Arm's efforts to bring simplicity and increased reliability into airborne systems, thus bringing tomorrow's aircraft—One Step Closer. Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 808, Pittsburgh 30, Pennsylvania.

20001



MAINTAIN typify the "package-engineering" which Air Arm applies to airborne systems. Simple and reliable as nose and cockpit, they are a rugged replacement for vacuum tubes. Whatever such packaging is used, maintenance is reduced, reliability is simplified and systems are far more dependable.

The most advanced state-of-the-art is always brought to bear in Westinghouse design, evaluation and improvement of airborne systems. For example, human engineering studies help technicians perform tasks quickly, simply and accurately. Building the required amount of dependability into the system.

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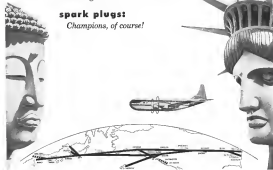
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Northwest Orient Airlines depends on Champion Spark Plugs to maintain schedules on the Great Circle Route to Manila



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destinations with good accuracy. (The device provides a dead reckoning computer which obtains drift information automatically from a Doppler radar.)

An early model of the auto navigators underwent stress tests by the Navy several years ago. Ryan is currently designing a replacement, more versatile model which will be completed next year. Cella expects it to displace equipment made by its avionic manufacturers. As Farns is also interested and has cleared a road for evaluation.

► **From Navigation to Hoisting**—Ryan's helicopter hoisting control, which Cella says "enables other very important functions besides hoisting," is another citysmith of the Fordland guidance technology. The company originally stated the development with its own funds, but is now working under Navy contract.

One experimental equipment has been given preliminary tests with more to follow.

► **Avionic Games at Cassini-Of** the SRI engineers which Cassini is looking at its current engineering staff again some programs laid out for avionic work, according to C. E. McCabe, assistant chief engineer in charge of electronics at San Diego. McCabe sums up the reason for Cassini's huge trunk connection the way it can achieve number one to combine to be a great contractor in future weapon systems, it must get into avionic R&D.

The company is particularly anxious to expand its avionic capability in analog and digital computers, for application to fire control systems and auto navigation control. McCabe says lack of such capability prevented the company from bidding on a superjet

test job for which it is now looking only for the future.

At San Diego, the company currently has three important avionic programs, all Cassini control, according to McCabe:

- Missile tracking and guidance
- Aircraft hoisting
- Avionic search radar

Most of the work is for USAF, most of it is a subcontractor to another firm. One program is for Navy Drones. ► **Be a Bigger**—At the moment, industry sees some aircraft concepts going into small-scale avionic production, and more of them making money into systems engineering. It doesn't matter whether the military people will eventually be brought to build most or all of the equipment themselves. About about this possibility, avionic company representatives take interest in terms which suggest that they themselves will see more about what the future holds.

For instance, at Ryan the guiding philosophy is to use the best source for the particular job. For its auto navigators, Ryan turns out some of the most classical analog computer elements, but also makes some of the "pure electronic" stuff. Ryan does considerable work in navigation, guidance, sensor and radars, including electronic, gyro, and production. Ryan has had experience with manufacturing. It has been from General Electric and other established avionic firms.

Cassini-San Diego, in addition to following "pure electronics," now also is building radar systems, precision electro-mechanical devices which were previously purchased from an avionic manufacturer. The avionic, according to McCabe, is that Cassini was disturbed with the quality and delivery of production systems supplied by this outside vendor.

McCabe speculates that the avionic supplier was trying to sell the avionic manufacturer by giving them a higher price on its design talent. If so, this indicates one of the hazards which an avionic manufacturer may encounter in trying to build, into the avionic business. It was also subjects one of the avionic aircraft companies are going into the avionic business themselves.

► **Philosophy**—Likewise, at Northrup, which has an important USAF missile program, a spokesman says the company intends "to manufacture some equipment in our own shops, subcontracting other components to our engineering heads on to others who can build to our specifications." The idea also stability supplier need to the F-10D offers an example. Northrup designed the system, then turned out the manufacture of much of the hardware to McDonnell Douglas.

Northrup reportedly broke profitability

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Side view of bomber shows shock lines. It is first production aircraft to have an advanced ambient temperature electric system.

Latest Air Force bomber has new G-E engineered power-generating electric system

NEW GENERAL ELECTRIC ENGINEERED SYSTEM MEETS DOUGLAS B-66 OPERATIONAL DEMANDS FOR HIGHER AMBIENT TEMPERATURES

A new *n-c* electric power-generating system has been developed by General Electric, and is now operating on the Air Force's newest, light bomber, the Douglas B-66. The system, composed of three major components: high-efficiency alternators, static voltage regulators, and generator control and protection panels.

DESIGNED FOR HIGH PERFORMANCE AIRCRAFT

With a generator that can operate at high ambient temperatures of high speed flight, the new G-E system is designed for long life and reduced maintenance time. Its static voltage regulator has no moving components to wear out, and water lubrication testing it has withstood 2000 hours of operation without maintenance.

Regulation is precise, and requires no pilot adjustment of voltage or load division. The control panel supplies the automatic control of shunt, load, open, and maximum

protection against ground fault, over and under voltages, and open phase.

SPEEDS TAKE-OFF, SPARES PILOT

The new equipment begins operating as soon as the pilot starts the engine. The system controls only two single switches, which may remain "on" at all times, even when a fault develops. This eliminates a series of pilot functions and sharply reduces the time required to become airborne. Under normal conditions, fault clearing and resetting are fully automatic.

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Static regulator (left) maintains constant alternator output voltage. Control and protective panel (right) large handle and cyclic handle generation.

New G-E high efficiency *n-c* generator has no bearings since it is protected from rotating when mounted in high temperatures in high speed aircraft.

Tests of system showed better protection against over voltages, over and under voltages, ground fault, under-voltage, difference current, and open phase.



Douglas B-66 takes off at Lang Beach, California, for its test run. Its electrical system was designed by G-E application engineers to deliver rated load with 10° C cooling air.

GENERAL  ELECTRIC



Torture tests prove built-in safety of Solar "Mars" gas turbine engines

THREE "LINES OF DEFENSE" assure absolute safety of every Solar "Mars" gas turbine engine. First, the governor holds the engine at rated speed (38,000 rpm in the unit pictured above). Second, overspeed and overtemperature shutdowns take over if the normal control system should fail. Third, physical limitations in the engine itself prevent various overspeeds.



This built-in safety was demonstrated in a special Solar torture test of the Mars. The engine was run up with no load and with all speed and temperature controls disconnected. At 50,000 rpm, speed leveled off because of design characteristics of the compressor and fuel system, and no damage to the power plant resulted.

In addition to its built-in safety, the Solar Mars engine has demonstrated rugged reliability and service life in airborne auxiliary power units. They have logged over 15,000 trouble-free hours with only normal maintenance on the Douglas C-119C Ghostrider. Both airborne and ground power units embodying the 60 hp Mars gas turbine are available. Write us, and we'll gladly tell you more about them.

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Guarantee engine meets all engine and military specifications. You control the design, we control the production. Guarantee to deliver engine in the most accurate manner, meet all military and industrial requirements in the U.S. and Europe.

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Rollers: Solar's 70-ton, 100-ton, 150-ton, 200-ton, 250-ton, 300-ton, 350-ton, 400-ton, 450-ton, 500-ton, 550-ton, 600-ton, 650-ton, 700-ton, 750-ton, 800-ton, 850-ton, 900-ton, 950-ton, 1,000-ton, 1,050-ton, 1,100-ton, 1,150-ton, 1,200-ton, 1,250-ton, 1,300-ton, 1,350-ton, 1,400-ton, 1,450-ton, 1,500-ton, 1,550-ton, 1,600-ton, 1,650-ton, 1,700-ton, 1,750-ton, 1,800-ton, 1,850-ton, 1,900-ton, 1,950-ton, 2,000-ton, 2,050-ton, 2,100-ton, 2,150-ton, 2,200-ton, 2,250-ton, 2,300-ton, 2,350-ton, 2,400-ton, 2,450-ton, 2,500-ton, 2,550-ton, 2,600-ton, 2,650-ton, 2,700-ton, 2,750-ton, 2,800-ton, 2,850-ton, 2,900-ton, 2,950-ton, 3,000-ton, 3,050-ton, 3,100-ton, 3,150-ton, 3,200-ton, 3,250-ton, 3,300-ton, 3,350-ton, 3,400-ton, 3,450-ton, 3,500-ton, 3,550-ton, 3,600-ton, 3,650-ton, 3,700-ton, 3,750-ton, 3,800-ton, 3,850-ton, 3,900-ton, 3,950-ton, 4,000-ton, 4,050-ton, 4,100-ton, 4,150-ton, 4,200-ton, 4,250-ton, 4,300-ton, 4,350-ton, 4,400-ton, 4,450-ton, 4,500-ton, 4,550-ton, 4,600-ton, 4,650-ton, 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supply includes a 3,500 psi. air motor. High pressure air is used to fill an air cylinder as necessary, which starts the line.

► **Pneumatic power**—low pressure—50 psi at 130 ft./min. at 75°F. Low pressure air is used to start retracting trapped and pneumatic sugar start and drive the work air cycle cooling equipment. A compact Allmach gas turbine supplies the low pressure air. It meets maximum output in 14-15 sec.

► **Refrigeration**—An air cycle refrigeration machine provides 94 ft./min. at 400, 2 gpm. at a 100°F dry flow at 100% efficiency or —112°. A modulating valve keeps air at any desired temperature within the operating limits of the machine. Refrigerated air cools a glass's cockpit and electronic components while they are on the ground. The refrigeration machine is a modification of a standard B-47 cool air unit.

► **Landing—Director pull** is 18,000 lb. (enough to tow a 100,000 lb. airplane). Model 8000 is powered by a 165 hp. Ford V8 engine and weighs 7 tons. It incorporates a forward controller and has two forward speeds and one reverse.

► **Model 1000 Details**—Reflected at and 6 ft. power supply cables in the Model 1000 are 16 ft. long and are stored in the structure unit. Cables are provided with "Change lead-off type" fittings at the end and which mechanically lock the cables to the service unit frame. This is so cables won't be torn out by the seats if someone accidentally drives the vehicle off without disconnecting it from the airplane being serviced.

Don't just wheels and four-wheel drive, provide maximum traction when used in need to tow heavy aircraft and allow it to maneuver through some rough road.

All components are easy to remove and replace, simplifying maintenance of the unit.

Among the components built into the unit are an oil separator and control panel for the gas turbine. Wiggins are constructed to the aircraft, and high pressure air compressor control panel.

► **Model MA-3**—Predecessor of the Model 1000 is the Model MA-1 multi-purpose ground servicing unit. The model USAF order for MA is for 940 units. The first one has supplied 675 conventional single ground support units (Model NC-5) to the Navy.

Here is what the MA-1 can supply to the way of power:

► **A.C. power**—60 line of 115/230 v., three phase, 900 kw.
► **D.C. power**—18.5 v., up to 2,150 amp.

► **Hydraulic power**—Up to 5,000 psi., an oil cooler is incorporated in the hydraulic power supply system.

► **Pneumatic power**—Up to 3,500 psi. at 375 cfm. A 3,600 cu. in. reservoir is provided in the pneumatic system.
► **Landing—Director pull** is capable of towing aircraft weighing up to 60,000 lb.

The MA-1 is also powered by a Ford V8 engine. It has a four-wheel drive and steering system with a combination transmission or a torque converter. The vehicle has a turning radius of 18 ft.

► **Design Features**—Here are some examples of the attention to detail paid by Consolidated Diesel engineers to the MA-1 design.

► **Engine exhaust** is at sub-top level to prevent heat or sparks from igniting fuel puddles on a ramp.

► **Headlight lights** have been provided fore and aft to avoid dazzling night vision of pilots working in planes around which the vehicle is moving. Lights also make the machine visible for service while parked on roadways.

► **Eyes at the controls** of the chosen profile housing and 16-dome attach points.

► **Slave plug** is located on right side of the vehicle so that outside power can be plugged into the unit in case its own battery goes dead.

► **Rear deck over control panel** is strong enough to hold several men thus providing a platform for them to stand on to reach high up on an airplane.

► **Tail gate** is built to accommodate the



New Flush Antenna

This engineering drawing is of the LPA 73A. The flush-mounted, low antenna is easily raised to protect by Bendix Radio. The antenna, which mounts low, normally will be used with Bendix ADF systems. It will work equally well with existing equipment in the field as with new equipment coming out next summer (such as the Bendix ADF70), says the company. The new collector bar reducing from the center of the antenna are made of a special ferrite compound, so are the compensating bars having all the ends of the collector bar. Purpose of the ferrite is to convert far field aerial waves produced by the antenna. On the Vector Mounting installation, ends of the compensating bars had to be covered in order to allow the antenna to fit within the 17 1/2 in. space Vector allowed in the air frame. This is the third major design change made to the antenna before it was released to production.

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30 ft long electric power lines quickly as the vehicle moves from one plane to another.

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• **Light** has spotlight with 160-deg search light for emergency, low beam on the rear.

• **Company History**—Consolidated Diesel Electric Corp. was formed in 1942 by Schaffel and a partner. Principal work was rebuilding motor/generators

for the armed forces.

In 1949 Schaffel bought out his partner and became president of the company. Shortly thereafter, he was a contract from the Navy for the NC-548 powered units.

In the fiscal year ending July 31, 1973, Consolidated Diesel did a business of under \$400,000. This grew to \$4.5 million in 1975, while 1975 was the firm's last year. The \$5-million mark. In 1974, volume exceeded \$10 million and sufficient backlog exists to ensure a 1975 sales volume figure of approximately \$10 million. Schaffel says.

Among products made by the com-

pany are gas-turbine and diesel engine-driven a/c and d/c generator sets with power outputs ranging from 5 kw to 250 kw, used in tanks, transport, self-propelled weapons support and recovery vehicles—guided missile launchers and servicing equipment and engine-driven floodlight units.

OFF THE LINE

Contract to modify and upgrade T2-C-41s has been awarded by Pacific Aerospace's Glenn (Cald) division. The contract is under the Air Force's SRAN (Support and Repair in Necessary) program. RAND is currently overhauling and upgrading T2-C-47 and C-119 aircraft for the Air Force, the company states. A \$300,000 contract to modify Air Force RB-57s has been received by Aircraft Engineering & Maintenance Co. Work, which will be performed at the company's Oakland base, includes extensive engine modifications to 11 aircraft to equip them for specialized missions. AFMCO, a subsidiary of Tennessee Air Lines, is presently overhauling and maintaining T-33 and P-44 jets and invasion ground units for USAF. Company has a \$6-million backlog.

Overhaul period of Pratt & Whitney R-4300-63A Wasp Major has been extended from 1,000 hours to 1,200 hours by the Third Air Transport Squadron, Brooksley AFB, Ala., accorded by P&W. The engine was installed in Douglas C-124 Globemasters.

New lathe exhaust system built to repair limited series 55-A-52 turboprop engines has been put on the market by Hapman Tool and Engineering Co. Firm says that the lat (already used extensively by a major airline) all four engines to be repaired at a fraction of the cost of a new engine and preserves the engine's life several times. Address: 1845 South Bundy Drive, Los Angeles 25.

Boeing's four-engine turboprop-powered Belovok transport will use Minnesota's new low-temperature, five-station liquidable fuel, Skydrol 180, according to qualified sources. A new booklet on Skydrol is available from Minnesota Chemical Co.'s Dupont Chemical Division, St. Louis 4, Mo.

Norris, Inc. has moved into a new air conditioned sales office and shop which gives it an additional 35,000 sq ft on the premises of its present warehouse at Lambert Field, St. Louis. The company is a distributor of aircraft parts and supplies for various aircraft

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OVERSEAS SPOTLIGHT

Italy's Share of Offshore

Italy's industry received 17.5% of share governmental orders for more than \$45 million worth of available ship space in the three years from July 1951 to July 1954. In addition, orders were given for more than \$31 million worth of electronic equipment, mostly related for aviation and sub-aircraft uses. Among the contracts:

- Aerofit, Republic: 754 parts, \$11,831,740.
- Fiat, Alfasud: 135 turboprop parts, \$9,120,114, assembling North American F-86, \$22,500,800.
- Finmeccanica Selenia, instruments, \$50,165.
- Italtel, takeoff mast rockets, \$1,357,722.
- Piaggio, overhaul of aircraft engines, \$82,500.
- Selenia, overhaul of aircraft engines, \$107,500.

Miles Studies French Wing

France is building a high speed aircraft wing for test at the Miles Aircraft light engineering, working to the wing which has enabled the D.D. 52 to carry greater loads and use shorter runway than conventional transports.

French sources say the French government is interested in the progress of this project.

Fiat in Trouble

The Fiat company has dismissed 370 workers employed in its aircraft division, Aeritalia.

According to the Italian press, this concerns reports of a serious situation at Fiat's Aeritalia and Terni. Export drops, due to lack of sufficient orders. The company is said to be considering winding up its aeronautic department.

Canadair Picks U. S. Bond

Canadair, Ltd. has decided to use an American adhesive-Bonamagrip 95M-4 in bonding applications on the C-119, a Canadian reconnaissance version of the B-24 Superfortress in building under license from Bristol.

The Bonamagrip makes extensive use of adhesive bonding in its aircraft (Aircraft Week, June 1, p. 16). As built by Bristol, the British parent of Bonamagrip is used. Choice of an American adhesive is in keeping with Canadian policy of looking for supply sources on the North American continent, but it has attracted disappointment on the British aircraft industry, according to state.



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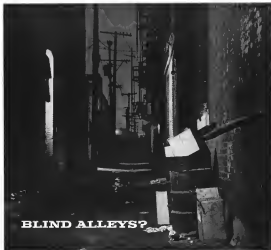
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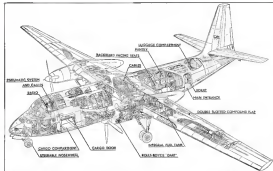
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TURBOPROP FRIENDSHIP's highway arrangement, fuel-water-firing unit and cargo compartments are shown in this cutaway.

Fairchild Survey Verdict:

F.27 Gains Favor as DC-3 Replacement

- Aviation consultants report interest of local service airlines and trunklines in turboprop-powered Friendship.
- Fokker will push production of new short-haul airliner; plans for U.S.-built version are likely to be speeded.

By Claude G. Wiles

Plans of Fairchild Engine & Airplane Corp. to build the Fokker F.27 Friendship, 25-passenger twin turboprop transport, for the U.S. market have been dramatized in recent weeks by two developments.

A market survey for Fairchild by Ray & Roy, Washington aviation consultants, has uncovered a promising market with good potential sales in local service airlines and airlines plus the business aircraft field.

Fokker Royal Netherlands Aircraft Factory, now building an F.27 prototype that will fly in May and be demonstrated in this country under Fairchild auspices before the end of 1955, will go ahead with production at once with-

out waiting for the flight test program. Fokker's decision to push production plans immediately was based on the results of its own survey covering sales potential in countries outside the U.S. In addition, the Fokker management is eager to take full advantage of its lead in the field.

Using the Netherlands plant will take considerable time, and the production rate will be slower than customary in U.S. aircraft plants.

Patented Growth—Fairchild's bi-cargo turboprop plans to build the plane in an Hagerstown, Md., plant was reported likely to proceed with greater speed as a result of the Fokker announcement and the Ray & Roy survey.

The U.S. company has a license

agreement with Fokker to build the Ray & Roy survey cannot be made available.

Aviation Week has been given some of the figures in the local service air line picture that indicate a growing potential for a plane of the Friendship's type.

DC-3 vs. F.27—Assuming all U.S. feeder lines were limited to DC-3s, they would fly 1,578 hrs. a day to accommodate their intercity traffic in 1956. This operation would need 235 planes. The F.27 Friendship, calculations show, could carry the same amount of traffic in 942 hrs. with only 175 transports.

Projecting the figure into 1960, if DC-3s were used for extended local carrier traffic, the airlines would need 300 planes flying 2,658 hrs. a day. With the F.27, passengers could be handled

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FRONT FUSELAGE section this shape at Fokker's factory.

with 239 passengers flying 1 177 in a day.

Even with a piece of the F-27 type approved and accepted, the aircraft would not be complete, although some new equipment must be introduced because clearly there will not be 562 DC-3s available in 1968. According to Civil Aeronautics Administration, peak passenger year for DC-3 operations, as existing aircraft enter in service, was 1946, when 574 were flying. The decline has been fairly regular since then, down to 351 in 1945 last year for which figures are available.

► **Fokker Operations**—Third quarter figures published by Civil Aeronautics Board in local current traffic report estimates for increased progress in the field of air transport. Compared with the same period of 1953, the passenger load factor on all DC-3 operations is up from 85.55 to 85.64. The average number of passengers carried increased from 41,019 to 42,790. Revenue passenger miles climbed from 12,147,000 to 13,897,080.

In the case of Midland Air Lines, figures for the same quarter in 1953 and 1954 show an increase in load factor from 52.81 to 68.13, while the number of passengers carried climbed from 47,518 to 68,577. Eastern Air Lines' load factor jumped from 41.33 to 52.35 and passengers carried from 32,881 to 44,467.

Non-mail revenue figures for the third quarters of 1953 and 1954 also are optimistic for the local aviation scene. For all DC-3 operations, there rose from 74,244 cents a mile to 61.79 cents a mile. Mohawk had an outstanding record in the period, its non-mail revenue jumped from 75.25 to 97.46 cents a mile. The figure for Southwest Airlines are 89.99 and 104.35 cents a mile.

In the third quarter of 1954, Mohawk's non-mail revenue fell only 0.55

cents a mile short of meeting its operating expenses, down from 27 cents in the same period last year.

► **Schedule Problems**—Interest in a two-part of the Fokker Friendship type of development continues to cause a serious problem for CAB. At least one airline, however, made a reluctant attempt to replace its DC-3s with modern 40-passenger transports. The Board refused to give a higher mail subsidy than was started by the old equipment, forcing the line to revert to the DC-3.

There is some feeling CAB may have to modify this policy before any local carrier can try to introduce a new and superior aircraft. There is no expense too that the airlines will not for a straight answer in mail subsidy to support a transport meeting higher operating costs than the DC-3. In fact, Fairchild and Fokker figures show the F-27 will result in economies.

However, in the case of the DC-4 operators who pioneer use of a new two-engine transport probably will need some assistance against heavy losses of "burn" expense.

► **F-27 Outlook**—Other factors considered by Fairchild in its study of the outlook for the new turboprop powered transport.

► **The Friendship** will be in aircraft in being next year. It will be possible to deliver a Fairchild-built F-27 early in 1957.

► **Language** continues for local service airlines may be approved. That would standardize content of messages and ease the problem of financing new equipment.

► **Introduction of Viscount** series by Capital Airlines next spring is certain to cause adoption by other carriers of the Rolls-Royce Dart turboprop engine, which will power both the Viscount and the Friendship.

At least in the beginning, F-27 operators presumably will have the benefit

of engine service provided by Rolls-Royce of Canada, an arrangement that will ease transition to maintenance in their own facilities.

► **Major troublemaker** in a replacement for the Constellation and Martin series clearly is evident. One school anticipates most of these airlines will be interested in two places, a four-turboprop transport of greater capacity than the present two-engine lines and an aircraft with the F-27's capabilities.

So far, other major U.S. manufacturer plans have been filed for their plans for a four-turboprop airliner. At least two, Boeing Airplane Co. had a heavy involvement in a project similar to the F-27, but the was shifted to the Fokker project before Fairchild entered the picture. Boeing then set its major effort into jet aircraft, abandoned by the 707 and airliner-bomber projects.

► **CNA Flight Tests**—Prototype of the F-27 will be flight tested in Amsterdam by CNA and certified by Holland's Civil Air Organization. An American built version probably will be priced in the \$400,000 to \$500,000 range.

The F-27 is a high wing design, 29 ft long, 26 ft 6 in. high and with a wing span of 55 ft. It will have a pressurized hull and a cabin capacity of 29 to 36 seats. Normal takeoff weight is given as 12,616 lb. Maximum gross is 14,200 lb. Normal disposable load varies according to configuration, from 33,045 lb. to 31,301 lb.

Maximum cruising speed at 20,000 ft will be 283 mph. Economical cruising speed at the same altitude is 265 mph. Normal stage distances is 360 mi., maximum 510 mi.

► **New Design**—Each of a true replacement for the DC-3 has been a subject of observation, debate and speculation for some years. American manufacturers have followed the market warily, only slowly and design have been on the boards in several major aircraft

W. W. Lindsay, Jr., Electronics Consultant
Chairman (left), Sherman C. Fry,
Ship Design Department Manager (center),
and E. F. Goodson, Liaison Section
Representative Manager (right),
conduct NATO college lecture plan
and radio performance.



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Too Many Ground Accidents?

Dr. McFarland urges airlines to adopt modern safety engineering to prevent employee injuries.

By Dr. Ross McFarland

While the advancements in flight safety as an transportation have been quite remarkable, the safety record for ground operations is in sharp contrast. In fact, the accident frequency and severity rates among line maintenance and base crew workers put them well toward the bottom in a ranking of the safety of 40 industries reported to the National Safety Council.

The airlines as a whole have been rather slow to take full advantage of modern safety engineering to prevent the wide variety of problems in the shop and hangar and on the ramp. Even now the safety departments of the fleet have not had equal status with those comparable with that existing in other established industries and are often a last barrier of economies.

Humanly As Man: The role directly of occupational hazards that are present within the limited working area of hangars, shops and ramps have an important factor in the poor record.

The pressure for maintenance of flight vehicles and the high efficiency of expensive transport requires a high integration of working crews and a heavy concentration of personnel and equipment in narrow limits of space and time.

Some hazards are inherent in the design of modern transport. Flares stand high off the ground, vehicles rounded and shielded for aerodynamic reasons offer little foothold and hand holds, and protrusions present no "take-a-step" warning. Inevitably, minor working spaces crowded with equipment of many kinds limit a variety of actions, hazards, valuable facts, information, and, in some cases, prevent procedures.

Analysis shows that the majority of working accidents occur in the power plant and cargo areas of transports.

What kinds of hazards? A striking feature of accident statistics among ground personnel is the very certain type of error, year after year, is almost the same proportions. Lacerations and abrasions and foreign bodies in the eye are the most frequent. Burns and fractures are most often involved, and the majority of these lacerations and abrasions result from the removal of tools, e.g., the slipping of a poorly fitting screwdriver on smooth.

Problems were attributed almost entirely to the use of obsolete techniques, screwdrivers and steel tools. Flying particles from grinding and sanding operations, have the slip chance of a pebble, or from the use of compressed air containers as soil hand to eyes.

An analysis like this can result in adoption of preventive devices.

The statistics constituted 81% of the last two accidents for one airline wherein in another, where hazards are comparable, the better control and use of protective devices kept one report to 2.5%.

Most important from the stand point of aircraft, though less frequent, are the many fractures and body injuries associated with improper handling of materials and lifts.

What Are the Causes? The accidents for one less in the maintenance of a large airline were studied. Half of the accidents were recorded as arising from five main causes: (1) unsafe practices in the use of equipment, (2) use of defective equipment, (3) unsafe practices in handling materials, (4) poor house keeping and job layout, and (5) misuse of equipment in the use of hand tools.

Included in each of these five causes are such implied factors as lack of experience, and inadequate training in the efficient and safe use of carrying on the respective tasks.

Training, Supervision, and Safety: In attempting to prevent ground accidents, the training and experience of workers require special attention. It is well known that turnover in high and maintenance rates are low among ground personnel. Consequently, a substantial number of employees are almost certain

to have no experience training, and most often miss during inexperienced maintenance personnel have been found to be higher.

The variety of tools and working conditions makes the standardization of procedures and even of personnel decisions difficult. Early, thorough indoctrination of a worker in safety principles, and training in safe working methods are essential. Inadequate experience also can increase accident rates materially.

Designing for Safety: One of the most important areas for supervising safety at maintenance bases or on the operating crews is the design of equipment in terms of human capabilities and limitations. Machines and working areas must be built around the worker, rather than placing workers in a setting without regard for each individual's requirements and capacities.

Unless this is done, it is hardly fair to attribute an increase in accidents to human failure in a one-way direction.

Human Engineering: All possible faults in equipment should be subjected to advance study for accident prevention. If defects are present, it is only a matter of time before some worker will "fail" and have an accident. Errors can arise if equipment is not suited to the worker's size or to his capacities and limitations. Thus, on human body size can be incorporated in equipment used at the design board.

Assessing, for instance, should influence the location of a control. Switch guards and machine supports should be so designed that work is within easy reach of the operator. The position required to work controls should be within the strength of a worker person expected to operate the machine. The limitations of human perception must be considered in the original design of gauges, meters, or dials if even are to be useful.

Basic Safety Principles: No safety program can succeed without sustained management support and discipline. Programs must also be based on a recognition that accidents are not inevitable. (1) The worker must be trained. (2) The working environment must be safe. (3) The worker must be equipped and (4) the work must be designed to prevent accidents.

The physical control of hazards is important, of no less importance is that which occupies the role of human factors. This control involves the selection, training and supervision of personnel and the design of equipment and working procedures with due regard to human capabilities and limitations.

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Time for a Nonsked Decision

Now comes a well-known personnel named, a "large irregular carrier," with the first of two new 102-passenger Douglas DC-6Bs, operating the first daily transcontinental gateway coach service in history. West-bound flights make one stop.

First across the aisle is on the company's DC-4B \$18 one way, plus tax. Scheduled carriers, offering coach to coast coach service in both directions with at least one stop, charge \$90, plus tax, with no special roundtrip rate. That carrier offers a roundtrip for \$160, plus tax, good Monday through Thursday.

The operator thus becomes the first "nonscheduled" coach carrier to offer, with little model aircraft, a transcontinental coach service faster than that of any scheduled airline.

Like most problems that are allowed to drag, the importance of whether to certificate nonscheduled carriers has been growing continuously as Civil Aeronautics Board has permitted it to drift.

The carrier's new service, with aircraft that cost over a million dollars apiece, suddenly demonstrates again the rising importance of irregular carriers and the importance of defining their role and regulating them.

Nearby coast-to-coast flights in new DC-6Bs can hardly be called third-class service. There is no longer any possible excuse for Board inaction in the confusion that this case has often grossly advised accommodations to those of regular carriers.

The Board has vacillated over the years in an erratic, stumbling series of threats, revocations, new regulations, deletions and varying interpretations of definitions that it has never fully known or made up as it went on the subject. Sen. J. McCarran, co-author of the Civil Aeronautics Act, said, "In seeking to write a definition of an irregular carrier (CAB) have made it difficult for a conscientious agency, who honestly seeks to run an irregular service, to know whether he is operating within the law or not. In the same way, they have opened up an avenue for evasion of the law, at which great advantage has been taken."

The Board's reluctance was against this particular line is a branch of an examiner, but Board people doubt if a decision can be reached in less than two to five months. It has dithered on the company's certification case for many months.

Both the certificated industry and the Board seriously underestimated the potentialities of the low priced aircoach market when the lowly nosked rat up step along with secondary DC-1s and is shortly after World War II ruled that the business goes constantly, despite a high bankruptcy rate among the nosked or irregular carriers. There are few common-carrier nosked left—most of them are charter operators—but the remaining group is the strongest of the lot.

By the time the Board wished to throttle the nosked, it found that a well developed public opinion—including some support on Capitol Hill—seemed to make action politically dangerous, so it still refused to take the nosked toll by the horns.

The scheduled industry probably could have elimi-

nated this poorly common carrier competition by 1953 by bracketing the nosked schedules, reducing fares a second time, from the \$99 coast-to-coast rate where it is now, down to \$75 or \$80. CAB probably would have welcomed such fare policies for nosked or third-class service. But the industry didn't go all out, either, and meanwhile the large irregular have grown.

The largest line alone reports to CAB that it hauled 180,280 revenue passengers in the first nine months of 1954, and Board officials guess that the fourth quarter may show as many as 65,000-70,000.

A few days ago, CAB announced that all irregular carriers will take about 650,000 passengers this year, for a total of 1.3 billion passenger miles. This includes military and civilian charter business, as well as common carrier traffic.

There appear to be three general decisions CAB could take: (1) it could permit the present chaos and uncertainty to continue, which is already counterproductive to both regular and irregular carrier alike, (2) it could attempt—unsuccessfully, we believe—to put most or many of the irregular carrier out of business, or (3) it could aver that there is a niche for the irregular, define it, and put those who want the requirements into it, under proper regulation. End the confusion!

Last April 19 on this page, *Airways Week* urged editorially that the government's Air Conditioning Committee in its then forthcoming recommendations on the new Administration's air policy "draw away some of the confusion and create a firm stand for common sense and management of this country's irregular operation without upending the financial foundation of any other segments of the commercial airline industry."

The report that came out later did, in fact, state that "some operations of large irregular carriers, such as low-fare charter and contract operations, can and do provide services which are supplemental to those regulated by regular route certificates. There appear to be a valid role which the irregular carrier can fill in this specialized market. It is appropriate for the government to encourage the development of this specialized market."

The report recommended some "basically new type of certificate" for large irregular carriers. It also said "in the future" there should be no general use of the existing law authority as a basis for authorizing "common carrier transportation to individually ticketed passengers on large transport planes."

President Eisenhower accepted the report May 26, and said it "reflects that Administration's control objective is that field—to strengthen American aviation. . . . CAB, however, did not participate in preparation of the action of the report dealing with nonscheduled operations "because of almost insupportable to cost now before it."

Now can CAB take any fearful or decisive action on the general subject since the President's Air Conditioning Committee report was accepted by the White House six months ago.

—Robert H. Wood

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